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NATO BURDEN-SHARING: REDEFINITION
FOR A CHANGING EUROPEAN THREAT

by

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NATO Burden-sharing: Redefinition
for a Changing European Threat

by

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ABSTRACT

This thesis develops a model of burden-sharing that includes both operational and non-operational contributions to the common defense. Based on the "Atlanticist" perspective of recognizing contribution, the model includes categories for standing forces, reserve forces, defense industrial capacity, reserve defense industrial capacity, and related defense factors that historically have not been recognized. This work addresses the availability of information suitable for the comparative evaluation of defense share within the model framework and identifies deficiencies in current data bases relative to the defense industrial capacities of participating nations. Recommendations for providing defense industrial base information center around tailoring OECD capacity utilization equations to defense industry parameters and reporting capacity and reserve capacity via the NATO Defense Planning Questionnaire.

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I. INTRODUCTION

A. BACKGROUND

The changing threat in Europe is destined to significantly impact the resolve of nations for fielding and maintaining large standing forces. Competing social and economic programs will erode financial support, and the perception of reduced threat will undermine popular support for such forces. The NATO Alliance will remain intact for some time but the definition and mission of that alliance may evolve to embrace global interests and mutual economic concerns.

Historically contributions to the near static balance of forces that preserved the status-quo in Europe served as a basis for the comparison of the defense burden among member nations. As the political and economic complexion of the European theatre changes, so will the definition of required defense capability for the NATO Alliance. While force and mission definitions remain unresolved, current dialogue and planning suggest a stronger emphasis on reserve forces. This potential change in the NATO force structure provides an opportunity to redefine burden-sharing within the alliance. The question of "fair share" in funding the alliance has always been difficult to define clearly, but as the evolution of NATO force requirements progresses, the way comparative burdens among participating nations is viewed must

also change. The approach in the past of comparing quantitative proxies must be expanded to include recognition of both operational and non-operational components, ensuring fair recognition for all members' contributions.

B. OBJECTIVES

The objectives of this thesis are threefold:

1. Develop an alternative model for evaluating defense burden shares which includes components of standing forces, reserve forces, defense industrial capacity, reserve defense industrial capacity, and related defense factors which have not previously been included in the burden sharing formula.

2. Explore information available to support comparative evaluation using the revised model.

3. Identify deficiencies in information bases and develop recommendations for the development of such data.

C. PRINCIPAL RESEARCH QUESTION

Can a model be developed that more fully incorporates the fundamental categories of defense contributions appropriate for NATO members following the realignment of Europe; and secondarily, are sufficient data currently available, or methods for obtaining such data, to support the proposed model of NATO burden-sharing.

D. SCOPE

This thesis will address an alternate approach to the current methods of quantitative proxies as measures of defense

burden-sharing within the NATO alliance.

A model incorporating standing forces, reserve forces, defense industrial capacity, reserve defense industrial capacity and other non-operational factors will be developed.

This work will not attempt to define an aggregate quantitative index for comparison of defense burden shares among participating nations, or specific indices for sub-areas of the burden-sharing model.

Emphasis will be placed on the identification of existing information and data bases, and the collection mechanisms for such information to support the future comparative evaluation of defense burden shares.

E. METHODOLOGY

The model of NATO burden-sharing proposed within, as well as the conclusions and recommendations drawn, result largely from a survey of existing literature and indications provided by current research and congressional testimony. Where possible, persons involved directly with NATO burden-sharing issues were consulted. Most of the information relevant to this study has been obtained from reference material less than five years old. That which provides the foundation for the proposed model, and forms the basis of underlying assumptions is current as of this writing. Where clear statements of policy or proposed policy are unavailable, assumptions based upon documented recommendations and "the most likely course of events" have been made.

F. ORGANIZATION OF STUDY

The following chapters are organized in such a manner as to present the general perceptions of burden-sharing currently influencing national positions relative to the alliance. These perceptions allow the framing of the burden-sharing problem in terms of different points of view, which will be described in detail later. This separation of approaches to the problem allows for a clear identification of the position from which the burden-sharing model presented in this work is developed.

A description of burden-sharing, and the limitations of those methods is followed by the development of the critical assumptions which provide the foundation for an alternative model. The model for a redefinition of NATO burden-sharing defines five basic categories of quantifiable contributions to alliance defense in terms of efficiency. The determination of the elements to be included in these categories is dependent upon the framework in which the issues are defined.

Limitations of the model will be discussed prior to specific conclusions and recommendations. Issues requiring further research are identified when resolution or further definition of such issues will significantly effect the implementation of the model.

G. LITERATURE REVIEW

1. Perceptions of Burden-sharing

The burden-sharing debate has been steeped in arguments of fairness and equity throughout the history of the NATO alliance. How these arguments are viewed is a function of perceptions. Cooper and Zycher [Ref. 1:p. 8] outline two fundamental approaches to the issues of burden-sharing: the "Fundamentalist" and the "Atlanticist." A brief survey of these approaches and associated perceptions are presented as background to support a model redefining burden-sharing.

a. The Fundamentalist

The Fundamentalist approach to burden-sharing is concerned with issues of fair share and the importance of equality of financial sacrifice and effort. This approach assumes that free-riding[1] is the major reason for lower

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[1] Defense is a classic example of a "public good." A public good is one that satisfies two conditions: first, it must be a joint consumption good, that is, one that can be simultaneously consumed by more that one person without diminishing the value to another; secondly, it is prohibitively expensive or impossible to deny access to those who have not paid for the good. Once provided, the benefits are available to all whether paid for by all or not.

Since defense meets the definition of a public good, nations within an alliance will enjoy benefits even as their contributions to the common defense vary. The economic incentive exists to decrease defense spending since this will not significantly decrease the total "defense" enjoyed by the nation. This "free-ride" tends to reduce the total quantity of the public good that is provided and shift the burden of cost to those who place the highest value on the good. Within alliances, free-riding results in a less than optimal amount of defense, and those who value that defense most highly will bear a disproportionate share of the cost.

defense shares in Europe. The Fundamentalist view holds that each member should spend proportionately as much as the other. Failing to do so warrants a reduction in spending by the major providers, and as a result decreased economic benefits to each member. For example, the United States has been considered a major provider to West Germany, such that failure to spend proportionately on defense by Germany would warrant reducing U.S. troop strength on German soil.

This approach is quite narrow in perspective. Expenditures on defense and defense inputs such as troops, guns, aircraft etc., are not the same for all participating countries. Nor can they be since the ability to pay or to produce is not the same.

Measuring defense burden as a proportion of gross domestic product attempts to equalize costs by providing that each member will contribute the same percentage of GDP. However, this aggregate approach does not take into account the differences in the marginal value of economic output among nations. Since members enjoy different levels of economic activity, some argue that a progressive correction should be applied such that those with the more advanced economies would pay a proportionately greater share of defense costs. This concept of "progressivity" is analogous to progressive income tax systems found in the United States and the United Kingdom.

The Fundamentalist view tends to ignore these limitations. Further, it gives no consideration for

contributions associated with host nation support and defense related aid within the alliance. As will be shown, it is very difficult to develop a measure of proportionate burdens when comparing only capital expenditures, defense hardware or troop equivalents.

The aggregate approach to defining defense burden fails for the following reasons. First, not all defense expenditures are directly related to the alliance. A high volume producer of defense goods, with additional non-alliance defense concerns is credited for more than the member who produces less but whose production solely supports the alliance. On the other hand, a highly efficient producer capable of achieving equivalent production output at less cost might be penalized relative to less efficient producers.

b. The Atlanticist

The Atlanticist approach is concerned with a practical solution leading to military efficiency, and enhancing alliance unity. Limitations on defense spending resulting from domestic political constraints are accepted. The Atlanticist approach is not focused on defense expenditures, but rather on military inputs that support NATO's commonly agreed upon defense strategy. Since the focus in not on defense spending per se, variability in defense spending amongst allies is accommodated by consideration for contribution to strategy and does not seek equalization of costs. This approach provides both benefits to the alliance

in terms of providing the inputs to effectively serve mission requirements, and benefits in terms of production specialization for the contributing member. While the benefits of flexibility and efficiency in the operational sense seem attractive, the lack of clearly defined target levels and production goals for each member makes this approach vulnerable to public criticism. The perception of equitable contribution among participating members of the alliance must be actively managed.

c. Comparative Views

Defense expenditures and military inputs are not the only measures on which the Fundamentalist and the Atlanticist differ. Perceptions also make a difference because they influence domestic political decisions and popular support. For the Fundamentalist, there is a static assumption that NATO's unity, cohesion and collective agreement are constant; that within the alliance there is a common perception of threat; and that there is an unquestioned belief in the commitment of the United States to the NATO alliance.

The Atlanticist approach is more attuned to differences in perceptions within the alliance. Efforts are directed toward developing common perceptions from which agreement on strategy and requisite defense commitment can be derived. Differences in perception need not always be resolved since the legitimacy of a national defense philosophy is recognized for all members.

A final point of comparison between the Atlanticist and the Fundamentalist involves how participation of U.S. Forces in Europe is viewed. The Fundamentalist sees the role of the United States as helping Europeans defend themselves, whereas the Atlanticist sees the direct involvement of U.S. Forces in Europe as serving the interests of U.S. national security.

A summary of key points associated with these alternative views of burden-sharing is provided in Table 1. [Ref. 1:p. 8]

Table 1

TWO APPROACHES TO BURDEN-SHARING

Fundamentalist	Atlanticist
• Focus on defense spending relative to GNP	• Focus on provision of military inputs to European defense
• NATO cohesion is assumed	• Strengthening NATO cohesion is a continuing objective
a. U.S. commitment fully credible	a. Credibility of U.S. commitment not taken for granted
b. Assumes a common threat perception	b. Narrowing differences in European and U.S. threat perceptions important
c. Assumes shared view of deterrent effect of conventional war-fighting capabilities	c. Recognizes differing views of deterrence
d. Out-of-area cooperation expected	d. Out-of-area cooperation has to be negotiated as a case-by-case basis
e. Domestic political constraints on defense spending seen as largely excuses for free-riding	e. Recognizes legitimacy of domestic political constraints
• U.S. forces in Europe to help Europeans defend themselves	• U.S. forces in Europe primarily to serve U.S. national security
a. Sees contribution of U.S. forces as solely military in character	a. Recognizes political contribution of U.S. forces to NATO cohesion
b. Withholding U.S. force would compel Europeans to spend more for own defense	b. Repercussions of withdrawing U.S. forces from Europe not certain

Source: Cooper and Zycher, *Perceptions of NATO Burden-Sharing*

It is important that the reader understand the differences between the two approaches to burden-sharing. Model development for this work will assume the Atlanticist perspective as it more closely fits the emergent political scenario for Europe in the 1990's.

2. Proxies as Quantitative Measures

To date, most approaches to the question of equity of burden within the alliance have been supported by indices derived from various data bases. The equity issue seeks to measure fairness. Gates points out that from an economic point of view, each member of the alliance should contribute an amount equal to the benefits received [Ref. 2:p. 6]. A fair distribution of the defense burden then, might have some members bearing a disproportionate share of the costs if those members also receive a disproportionate share of the benefits. Given that fairness has yet to be defined within the context of the NATO burden-sharing issue, members have evaluated contributions by comparing quantitative proxies.

Quantitative proxies used to measure defense burdens can be categorized by measurement type: input measures and output measures. Input measures seek to define the resources a nation assigns to defense production or procurement, usually as a function of Gross National Product (GNP), or Gross Domestic Product (GDP). Output measures view how nations' defense expenditures contribute to the overall capability of the alliance.

The use of proxy measurements in the burden-sharing debate fails to clearly define the position of the member nation for three reasons: first, the approach fails to consider benefits derived from participation in the alliance; second, it is not possible to find common ground between nations on which expenditures should be included in the measurement base; and third it is very difficult to adjust contributions or expenditures for ability to pay.

a. Opportunity Costs and Discounting

The concepts of opportunity cost and discounting are central to the failure of quantitative proxies to clearly establish the level of contribution and subsequently the fairness of that contribution.

Opportunity costs are defined as the value of an option forgone as a result of selecting an alternate economic activity. A nation considering its position relative to others in the alliance must do so by considering what must be given up internally to increase defense expenditures, or what can be gained domestically by decreasing the amount of resources committed to defense. This is often the focus of debate internally as popular support is sought to increase or decrease defense expenditures.

Opportunity costs differ between countries. Marginal analysis provides that the value of the last dollar spent will be different for two countries purchasing or producing goods. Additionally, efficiency considerations

dictate that dollars spent on defense will provide varying quantity, quality and capability between member nations. Member nations recognize these differences in marginal value and efficiencies, and as a result discount the contributions of other participating nations. The process of discounting then, is not recognizing the full value of the other members' contributions, which results in a relative increase in one's own comparative expenditures.

Within the NATO alliance, and throughout its history, the principal of autonomous national defense decisions has been unanimously supported. Spending levels for members' contributions to the alliance are determined by the member nation and are driven by national interests. Because of this, discounting is inevitable. Nations will always discount the contributions of other nations because of judgments on comparative efficiencies, relevance of contributions to the alliance, and the national strategic value of alliance objectives [Ref. 1:p. 15].

Perceptions of burden-sharing issues are critical from all vantage points within the alliance. Participants in any burden-sharing debate must filter information through logic that accounts for bias and motives that are naturally at work in all member nations. Because such variations in perception exist, national motives often eclipse alliance needs. For that reason the "Atlanticist"

approach best serves as a basis for the development of this model.

3. Current Methods

"Any attempt to compare the burden-sharing efforts of individual countries must be made with caution, given the wide variation in the countries' ability to contribute to the collective defense." [Ref. 3:p. 2-2] Even with the known inherent limits of quantitative proxies as representatives of the defense burden, they continue to be the primary source of analysis.

The Department of Defense, in its annual report to Congress on the allied contribution to the common defense, uses three categories of quantitative measure. These are: (1) indicators of a nation's ability to contribute; (2) indicators of a nation's actual contributions; and (3) indicators that measure nation's actual contribution as a function of their ability to contribute [Ref. 3:p. 2-1]. Additionally, most comparisons utilize these quantitative measures by expressing them as a relative measure, such as a share of a combined total, or as a percentage of the value of the highest ranking nation. The most common measurement bases are gross domestic product (GDP), and per capita gross domestic product, since these are commonly used as indices of economic development and standard of living. As such, the actual contribution to defense is commonly considered as a proportion of GDP or per capita GDP.

a. *Indicators of Actual Contribution*

The following discussion addresses the eight major measures of contribution to defense currently used by the Department of Defense in the analysis of shared burden. Consideration for data problems and limitations of these indicators are included.

Since the official U.S. estimates of Allied contributions are provided in an annual report to Congress by the Secretary of Defense [Ref. 3], those definitions and descriptions will be used in this work to provide consistency.

Efforts to measure defense contribution draw heavily on a nation's ability to contribute and indicators of actual contribution. Indicators of ability to contribute include gross domestic product share, population share, and per capita gross domestic product. These elements are defined as follows: **gross domestic product share**, the total value of goods and services produced by a country in proportion to total NATO GDP; **population share**, the total amount of human resources available to each nation in proportion to total NATO population; and **per capita GDP**, which is gross domestic product divided by population. [Ref. 3:p. 2-10] These indicators provide a base from which relative contribution is measured.

The analysis of actual contribution is based on eight selected indicators. [Ref. 3:p 2-5] These are: defense spending share, percentage change in defense spending, active

defense manpower share, percentage change in active defense manpower share, active and reserve manpower share, ground force division equivalent firepower (DEF), air force tactical combat aircraft share and naval tonnage share.

The content of these indicators is described as follows: ***Defense Spending (Fiscal Year)***. Officially recorded defense share figures which are based upon a commonly agreed NATO definition of what is to be included as defense spending. While this is the most comprehensive indicator of defense effort, it measures input, not output, and makes no allowance for such non-operational factors as host nation support or contributions to developing defense industries (DDI).

Percentage Change in Defense Spending (Fiscal Year 1971 vs 1988). This measure provides an indicator of changes in real defense spending in constant 1971 dollars. Current figures (1989-1990) have been computed using constant 1988 prices and exchange rates, though firm figures for these years are not yet available. [Ref. 3:p A-11, fn. 1]

Active Defense Manpower Share. A measure of active duty military and civilian manpower levels in peacetime. Because the use of civilian personnel for military tasks varies from country to country, inclusion of these figures allows a better assessment of the total defense related manpower pool.

Percentage Change in Active Defense Manpower Levels (1977 vs 1988). Provides an indicator of changes in peacetime active-duty defense manpower resources.

Active and Reserve Defense Manpower Share. Includes peacetime active-duty end strengths and civilian manpower levels, plus an estimate of "committed reserves." Committed reserves are those that will mobilize to attain wartime authorized strength.

Ground Forces Division Equivalent Firepower (DEF) Share. Measures the effectiveness of ground forces as a function of the quantity and quality of their major weapons. This measure provides a reasonable comparative basis for non-similar units. It should be noted that critical combat factors such as sustainability, logistical support, training, communications and morale are omitted.

Air Force Tactical Combat Aircraft Share. A numerical assessment of major types of combat aircraft in inventory, including fighter/interceptor, fighter/bomber, conventional bomber, and tactical reconnaissance aircraft in air force inventories. Naval and Army aircraft are accounted for under separate categories.

Naval Tonnage Share. Includes the aggregate tonnage of all major classes of ships, excluding ballistic missile submarines.

4. Limitations of Current Methods

It is clear that any approach to measuring defense is limited by the quality of the data upon which comparisons are made. These include problems associated with fluctuating currency exchange rates, differing approaches to defense

budgeting, and the fact that no quantitative measures effectively measure the quality or the will of military forces. Data used in comparisons are usually provided by the country in question, and each country has its own budgetary, financial and tax systems. Each has a different method of recruiting, training and equipping manpower, so comparisons on personnel matters are difficult. It is additionally likely that nations will provide data in such a way as to favor their own position. Quoting from a Congressional Research Service report to congress [Ref. 4:p. 50-51]:

> Thus, determining what constitutes an equitable sharing of alliance burdens is an important but, ultimately, subjective political process. There is no scientific formulation for determining objectively precise and "fair" shares of cost/benefit relationships. Self-interest naturally dictates that U.S. officials should try to get the allies to take the actions necessary to relieve the defense burden confronting the American people. Similarly, European and Japanese officials see it as their responsibility to pursue defense spending policies and diplomacy that will secure the maximum benefits for the least cost to their citizens.

Then by necessity, subjectivity on the value of input information and subsequently limits on the value of comparative defense burden must be accepted.

NATO has attempted to deal with some of the comparative problems of the burden-sharing issue by agreeing on a common definition of what constitutes defense expenditures. This agreement contains very broad definitions, and does not undermine the NATO premise that actions taken by

a nation in support of the alliance will be taken is such a way as to support the national defense requirements first.

Under the NATO agreement, expenditures for a given period must represent payments made for that same period regardless of when funds are disbursed for accounting purposes. Indirect costs associated with national tax or accounting systems are not counted as payments. Domestic security forces may be counted as contribution to the common defense if they are issued military equipment, have had military training and would come under military authority during wartime. Nations may count military pension systems and unreimbursed military assistance to other members of the alliance. Nations may not count the costs of war damage, veterans' benefits, civil defense, or the stockpiling of strategic materials [Ref. 3]. Conspicuously absent from the agreement are credits for defense related issues, and social issues that support economic growth or enhance cohesion within the alliance. Many would argue that credit for host nation support should be available to those nations with NATO infrastructure obligations. Others feel that social program investment and economic growth issues also have a place in the formulation of "fairness of share."

As stated in the Secretary of Defense's Report on the Allied Contribution to the Common Defense, April 1990: "The definition (of burden-sharing) is substantially complete but does not cover all the possible cases. Any division between

defense expenditures and other public outlays which contribute to NATO security is partially and necessarily arbitrary." Clearly then, examining the current definition of defense expenditures with an eye on expanding that definition to include more non-operational issues is worth pursuing.

II. NATO BURDEN-SHARING: REDEFINITION FOR A CHANGING EUROPEAN THREAT

A. CRITICAL ASSUMPTIONS

The world's political situation is changing at a blinding pace. To project beyond the current dynamic state to a static balance of military and political forces is impossible at this time. Accepting these limits on defining the future balance of world power, certain critical assumptions must be made to allow the development of any model of force structure and the associated costs.

The assumptions that follow are supported by current reports and recommendations from within the Department of Defense and by independent study groups. These assumptions and subsequently the burden-sharing model that follows will not deal with the implications of the debate between the continental and maritime strategies or their competing demands for resources. Rather, the following assumptions begin by recognizing the NATO-Warsaw Pact status quo as the historical equilibrium point from which the system must move in balance.

The model that will be developed is based upon the following four primary assumptions.

1. NATO as a defense alliance will remain intact through the year 2005.

2. NATO will scale back its commitment of operational forces in light of the perceived reduction of threat associated with the Soviet Union and the Warsaw Pact.

3. There will be a diminishing political resolve of participating nations to maintain large, standing military forces.

4. As both the requirement and support for large standing forces decreases, the defense commitment will shift in part to reserve forces and reserve industrial capacity.

The following chapter will examine these assumptions and related issues in the context of burden-sharing, and the roles each will play in the development of a redefined burden-sharing model.

1. NATO's Defense Role Will Remain Viable Through the Year 2005.

From the point of view of the NATO alliance, the perception of threat in Europe is changing. Throughout the history of the NATO alliance, the organization has been successful in maintaining peace in the European region. Because of this success, there exists both popular and political trust for both the mission and the capabilities of the alliance. Granted, factions exist that argue that the need for the alliance is past, and there are those who contend that the very existence of such an alliance only serves to undermine the prospects for peace. Such factions have always existed. Consensus, however, has generally supported the alliance.

The defense role for NATO, to be distinguished from a diplomatic or economic role, will remain at least until a new military balance emerges and economic stabilization is at hand. For purposes of this work, it is assumed that the basic defense obligation will remain as the primary role through the year 2005.

While it is likely that the alliance as it exists today may evolve to something quite different, for the present NATO is expected to serve as a stabilizer during the build down of conventional forces in Europe. Further, the alliance will help guarantee regional security while the Soviet Union redesigns its economy and while the European Economic Community emerges and formally stabilizes.

The fragmentation of the Soviet Union raises questions for regional security that cannot be answered at this time. For example, the reunification of Germany, with its great economic potential and legacy of aggression, may not be viewed as contributing to stability by some members of the European community. NATO may well serve as the controlling structure through which a united Germany can stabilize its economy. Additionally, questions concerning a reversal in the new policies and programs within the Soviet Union must remain, including retrenchment and the reemergence of a stronger Warsaw Pact.

The European theatre is not the only area that will require a defense commitment in the future. While NATO has

historically resisted the commitment of forces to out-of-area operations, the increasing threat by third world nations and terrorism will soon pressure NATO to assume the operational roles to counter such threats.

> The alliance may serve as a unified, credible deterrence to global third world terrorist activity and insurgencies. The alliance must consider lesser conflicts with the Soviet Union along the Soviet periphery, the advent of potential third world adversaries armed with advanced weaponry, and third world "low intensity conflict" [Ref. 6].

Such threats clearly exist, as witnessed by the Iraqi invasion of Kuwait, and the economic vulnerability felt by all who depend on the petroleum exports of the middle east.

NATO is expected to remain a strong military force for some time to come, to quote Secretary of Defense, Richard B. Cheney [Ref. 7:p. 1]:

> Despite the dramatic and promising changes in Eastern Europe and the Soviet Union, the risks remain high - especially as the nations of Eastern Europe commence to reassess their policies to reflect changed realities and heightened expectations. As the process advances NATO must guard against Soviet retrenchment, the outbreak of irredentism in Eastern Europe or other contingencies that could prove disruptive to further progress toward peace and prosperity on the basis of democratic freedoms. Policy reversals remain for the Soviet Union a far easier undertaking than for Western Nations. NATO planning must account for the uncertainties and recognize that while Soviet military power may be declining somewhat that is no reason for the alliance to relax its vigilance.

2. NATO Will Reduce Operational Force Commitments

The assumption that NATO will scale back commitment of forward deployed/operational forces is proposed in light of a perceived reduction in threat associated with the Soviet

Union and the Warsaw Pact following the fragmentation of the Warsaw Pact, and a successful conclusion to the Conventional Forces in Europe talks (CFE).

It is expected that the CFE talks will be signed by late 1990. Further, a summit has been called for late 1990 to approve a signed treaty. CFE represents the linchpin in arms control talks between NATO and the Warsaw Pact on the reduction of conventional arsenals in Europe [Ref. 8:p. 22-28].

The force levels provided for by a successful CFE agreement will provide the framework for a controlled build down in active-duty operational forces that must be supported by the NATO alliance. While those force levels have yet to be established, significant action has already been taken within the alliance which will ensure a decreased commitment to the current operational force structure.

In April 1990 it was reported that NATO had officially abandoned the three percent real growth target for defense spending in lieu of an adjusted formula that has not yet been published [Ref. 9]. These anticipated cutbacks and reassessments of growth requirements are clearly a result of the perception of decreasing regional threat.

3. Diminishing Political and Popular Resolve for Maintaining Large Standing Forces.

The political resolve to field and maintain large standing forces is clearly associated with the perceived threat to national security. The obvious threat associated

with the Communist block has fueled support by nations to spend, in varying amounts, to ensure security.

Today we observe communism as a failing economic doctrine and the Warsaw Pact in a progressive state of fragmentation. Given the initiatives ongoing within the Soviet Union and other planned economies in Eastern Europe, it is assumed that over time, the product of these initiatives will be some form of market economies. The deficiencies resulting from the failed systems, that is, low productivity and an inadequate distribution system, will generate increasing pressure to meet basic consumer needs. To satisfy the demand for goods, tremendous capital expenditures will be required to develop the production capability, capacity, and a market distribution system. To accomplish this, it is likely that resources from defense programs will be diverted to economic development programs. This anticipated decrease in defense spending within the Soviet block is expected to precipitate a comparable decrease in NATO defense spending.

The obvious relationship is drawn between perception of threat, force levels and expenditures. The reader should note the role CFE will play in the public perception of a reduced military threat. The conclusion feeds the assumption that a reduced perception of threat will erode popular political resolve to support large standing forces.

4. The Alliance Defense Commitment Will Shift in Part to Reserve Forces.

As both the requirement and support for large standing forces decrease, the defense commitment in part will shift to reserve forces.

Reserve forces represent a financially attractive option. For example, active U.S. forces incur military personnel (MILPERS) and operations and maintenance (O&M) costs at least 50 percent higher for tactical air forces and 400 percent higher for ground forces than their reserve counterparts. [Ref. 10:p. 40] It is important to note, however, that any shift in force structure entails certain transition costs and personnel turbulence costs which partially offset the advantages.

The concept of a shift in part to a reserve force structure is contingent upon the assumption than an unambiguous and politically useful warning time would be available to mobilize these reserve forces, to bring them to full capability, and to deploy them to their battle stations [Ref. 10:p. 40]. Additionally, response time can be decreased if equipment is prepositioned at or near the designated theater of operations.

The decision for increased reliance on reserve forces hinges in part on the Conference on Security and Cooperation in Europe (CSCE). Talks associated with the conference aim to minimize the opportunity for surprise attack. Successful outcomes of both the CFE and CSCE talks are expected to

provide a warning window adequate to allow a shift to an increased reserve force structure.

5. The Role of Defense Industrial Capacity and Reserve Defense Industrial Capacity.

By accepting the applicability of reserve forces in meeting defense commitments, we accept the idea of mobilization and "spool-up" to wartime footing. Part of any mobilization capability to support prolonged operational actions is the ability to bring defense and defense related industry output levels up to meet operational resupply needs. Not all sustaining materials and equipment can be prepositioned or held in inventory.

For purposes of this model it is assumed that increased reliance on reserve forces will include the development of reserve industrial capabilities to support such forces on a wartime footing. Modern concepts like "dual-use" facilities will be important in the development of such capabilities. Dual use implies joint NATO/commercial partnerships that would permit the use of key facilities for commercial purposes during peacetime while preserving their irreplaceable capabilities for military use during crisis [Ref. 6].

Such development of defense industrial capabilities as part of the reserve component of standing military forces can be expected to stimulate collective and individual economies of the alliance. By establishing defense, defense related, and dual-use industrial capabilities it is possible

that participating nations may develop production advantages, and as a result, a position favorable to international trade.

The assumptions developed in this chapter are made recognizing the dynamic state of world politics and the diversity of popular and political pressures that are at work within member nations. As with any attempt to model a multi-variable, dynamic environment for which clarifying assumptions have been made, questions and assertions contrary to those assumptions can be presented that undermine the validity of the model. Mindful of this modeling limit, we will proceed with its development.

B. NATO BURDEN SHARING: REDEFINED

In developing the following model for the defense burden within the NATO alliance, we will draw upon the assumptions that have been posed in the preceding chapter. These assumptions are based on the political implications of a significantly reduced Soviet military threat and the dissolution of the Warsaw Pact as a credible defense alliance. These factors are expected to act upon the NATO alliance in such a way as to reduce operational requirements in terms of the commitment of real resources.

As developed in the background sections of this paper, the commitment of resources has historically been the principal measure for comparing defense burden shares within the alliance. This is normally accomplished by the use of quantitative proxies.

Accepting the perceived reduction of threat, and the accompanying diminishing political resolve to field and maintain large standing forces, an alternate model, which recognizes the less quantifiable aspects of contribution to defense burden is proposed. This model recognizes an emergent structure resulting from reduced operational force requirements within the alliance. This new structure will provide the focus for comparison of defense burden and is illustrated in figure 1.

NATO BURDEN–SHARING

Redefinition for a Changing European Threat

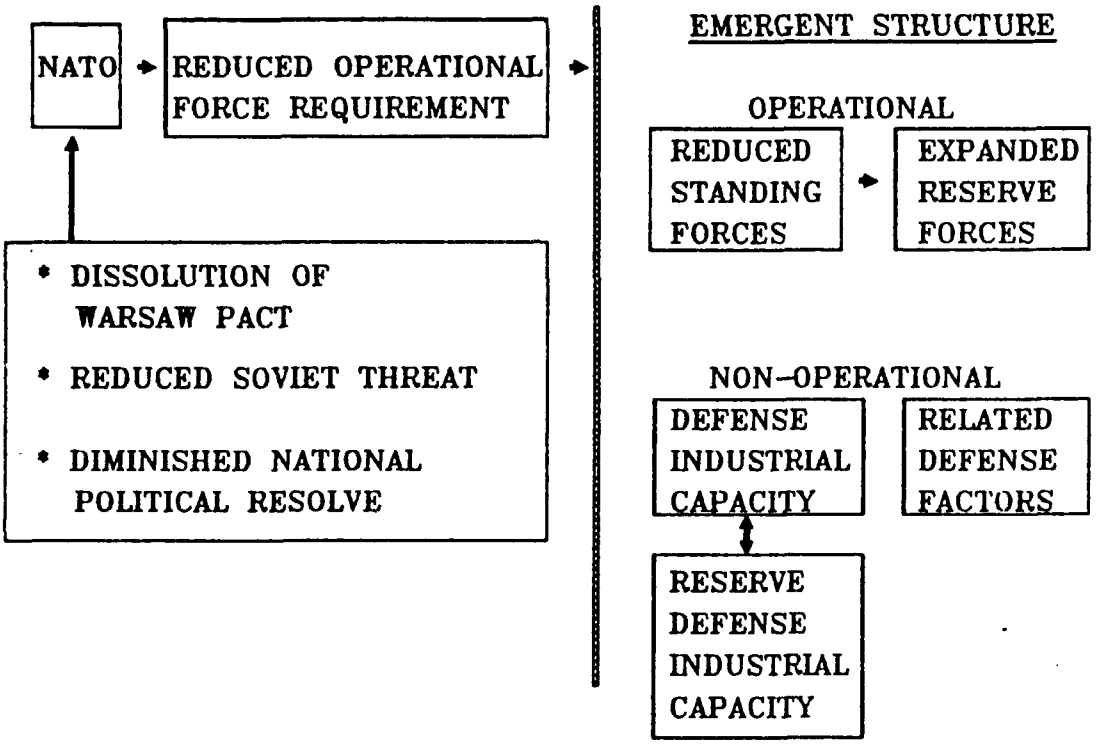

Figure 1

The proposed model for re-defining defense burden shares within the NATO alliance is composed of both operational and non-operational factors (figure 2). The operational factors include standing military forces and reserve military forces. The non-operational factors include defense industrial capacity, reserve defense industrial capacity and related defense factors such as host nation support, civil emergency planning efforts, aid to developing countries and aid to developing defense industries.

NATO BURDEN-SHARING

Components of the Defense Burden

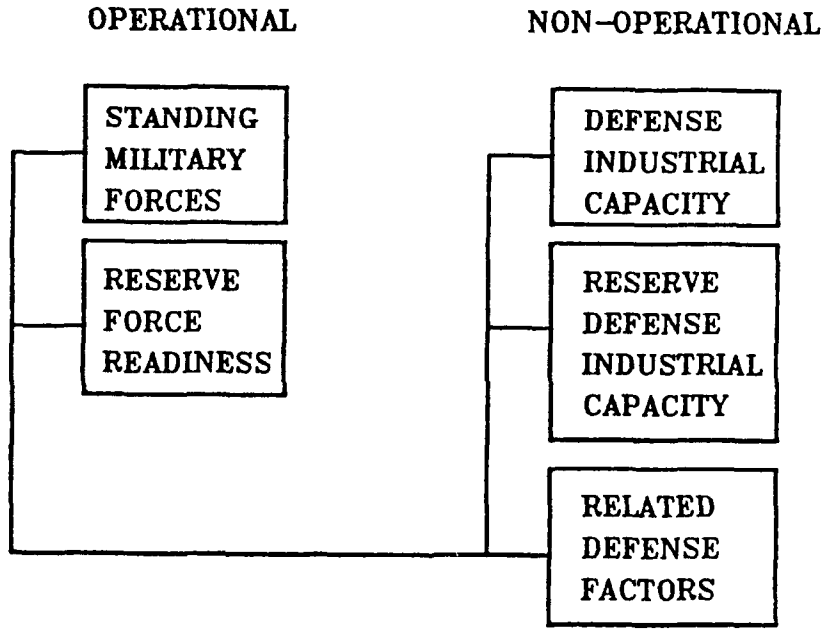

Figure 2

The discussion of the individual components of this model will not attempt to quantify comparative burdens between member nations, but will explore information and data requirements to support comparative evaluation. Additionally, the availability of such information will be examined, deficiencies addressed and recommendations developed for the provision of such data.

1. Standing Military Forces

The component of the defense burden that is most readily quantified is that which describes the standing military forces that are fielded and maintained by member nations to serve the stated requirements of the NATO alliance. These forces, which include all deployable manpower and weaponry, are currently tracked for all member nations. Table 2 shows active duty military manpower as reported by the Secretary of Defense to Congress in the annual report describing allied contribution to the common defense [Ref. 3]. Of note is the fact that data are included for Japan, recognizing vital interests and a possible defense role for Japan in the NATO arena.

Table 2

Total Active Duty Military Manpower
(Thousands)
(Excluding Spain)

	1971				1988				Total % Change
		% of NATO & Japan Total	% of NATO Total	Rank		% of NATO & Japan Total	% of NATO Total	Rank	71 vs 88
Belgium	106.8	1.7%	1.8%	11	110.0	1.9%	2.0%	9	+3.0
Canada	86.9	1.4%	1.4%	12	87.6	1.5%	1.6%	12	+0.7
Denmark	44.5	0.7%	0.7%	13	29.8	0.5%	0.5%	14	-32.9
France	569.3	9.0%	9.3%	3	557.9	9.6%	10.0%	3	-2.0
Germany	472.0	7.5%	7.7%	5	495.0	8.5%	8.8%	4	+4.9
Greece	178.7	2.8%	2.9%	9	199.3	3.4%	3.6%	8	+11.5
Italy	526.0	8.3%	8.6%	4	446.2	7.6%	8.0%	5	-15.2
Luxembourg	1.1	0.0%	0.0%	15	1.3	0.0%	0.0%	15	+19.8
Netherlands	113.0	1.8%	1.9%	10	106.7	1.8%	1.9%	10	-5.6
Norway	36.3	0.6%	0.6%	14	40.2	0.7%	0.7%	13	+10.8
Portugal	244.2	3.9%	4.0%	7	103.7	1.8%	1.9%	11	-57.5
Turkey	614.5	9.7%	10.1%	2	847.1	14.5%	15.1%	2	+37.9
UK	384.0	6.1%	6.3%	6	323.7	5.5%	5.8%	6	-15.7
US	2714.0	42.9%	44.6%	1	2246.0	38.4%	40.1%	1	-17.2
Non US NATO	3377.3	53.4%	55.4%		3348.5	57.3%	59.9%		-0.9
Non US NATO + Japan	3611.6	57.1%			3595.7	61.6%			-0.4
Total NATO	6091.2	96.3%	100.0%		5594.5	95.8%	100.0%		-8.2
Total NATO + Japan	6325.5	100.0%			5841.7	100.0%			-7.6

Decreasing standing force size is expected to be reflected in these annual totals. This information, which is groomed and maintained by the Department of Defense, can provide the quantitative element for manpower in the burden-sharing model.

Simple manpower count however, is inadequate for assessing the defense contribution to standing forces. Factors such as manpower as a percent of total population (table 3) and Division Equivalent Firepower[5] (table 4) are also considered. Additional components of operational standing forces are provided in Appendix A, and include tactical aircraft and Naval tonnage.

With respect to the burden-sharing model proposed in this work, the standing military forces component does not require new data generation or tracking as compared to current burden-sharing analysis efforts.

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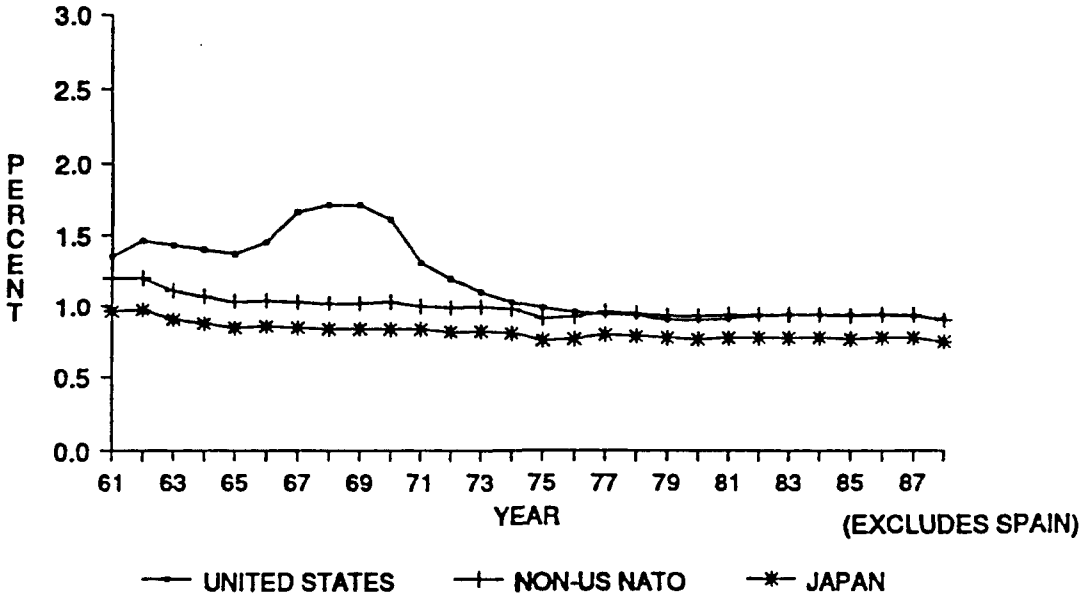
[5] Division Equivalent Firepower (DEF) is an indicator of ground forces combat power based on the quantity and quality of major weapons. This measure draws on the static assessment techniques used in the Armored Division Equivalent (ADE) methodology with additional improvements made to portray more accurately NATO equipment modernization. The DEF methodology, which is widely used within DoD and NATO for ground forces comparisons, provides a more comprehensive picture of combat effectiveness than do simple counts of combat units and weapons. The measure deals mainly with weapons' capabilities; it does not consider such factors as ammunition availability, logistical support, communications, troop training, and morale. At this time there is no generally accepted stated measure of ground combat capability that incorporates all of these factors. (Source: DoD)

Table 3

TOTAL ACTIVE DUTY MILITARY MANPOWER
AS A PERCENT OF POPULATION



TOTAL ACTIVE DUTY MILITARY MANPOWER
AS A PERCENT OF POPULATION

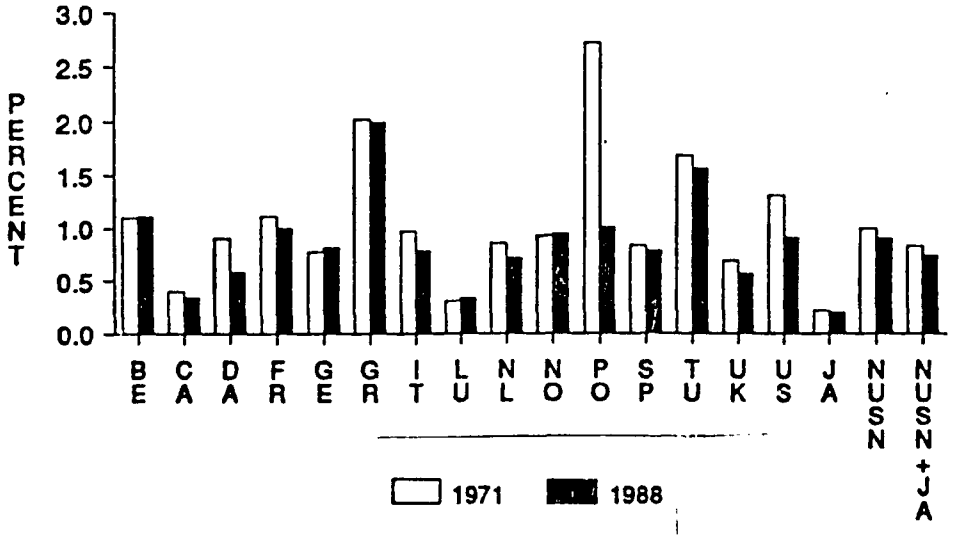


Table 4

Division Equivalent Firepower (DEF)

	1988		
	% of NATO & Japan Total	% of NATO Total	Rank
Belgium	1.4%	1.5%	11
Canada	0.8%	0.9%	14
Denmark	1.3%	1.3%	13
France	6.0%	6.2%	4
Germany	10.6%	10.9%	2
Greece	5.2%	5.4%	5
Italy	4.2%	4.4%	6
Luxembourg	0.0%	0.0%	16
Netherlands	3.2%	3.3%	10
Norway	1.3%	1.4%	12
Portugal	0.6%	0.6%	15
Spain	3.3%	3.4%	8
Turkey	10.0%	10.4%	3
UK	3.8%	3.9%	7
US	45.0%	46.5%	1
Japan	3.3%		9
Non US NATO	51.7%	53.5%	
Non US NATO + Japan	55.0%		
Total NATO	96.7%	100.0%	
Total NATO + Japan	100.0%		

2. Reserve Force Readiness

Statistical information for Committed Reserve Force[6] manning is currently maintained by the Department of Defense and reported annually with active force manning levels. Reporting is limited to the Committed Reserve and says little about the sophistication of equipment (DEF), or mobilization time requirements. As the emphasis on reserve force readiness increases, so should the reporting and data maintenance requirements.

It has been recommended that the United States make more extensive use of reserve forces as substitutes for active duty forces [Ref. 10:p 50]. It has also been recommended that as forward deployed forces demobilize, their weapons should be turned over to host nations for use by their active duty or reserve forces [Ref. 10:p ix]. This can be expected to have a significant impact on the DEF of those forces and as a result make their weight in defense contribution more meaningful.

Reserve reporting should be expanded to include all reserve mobilization potential. This of course must consider such things as National Guard and National Police units meeting the definition of defense units, mobilization time and division equivalent firepower.

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[6] Committed Reserves are defined as reservists mobilized to attain wartime authorized strength.

The following data illustrate current reporting on total manpower, including civilian and committed reserves forces (tables 5,6,7). These data are maintained by the Department of Defense and reported annually [Ref. 3].

Table 5

TOTAL ACTIVE DUTY MILITARY AND CIVILIAN MANPOWER AND COMMITTED RESERVES AS A PERCENT OF POPULATION 1988

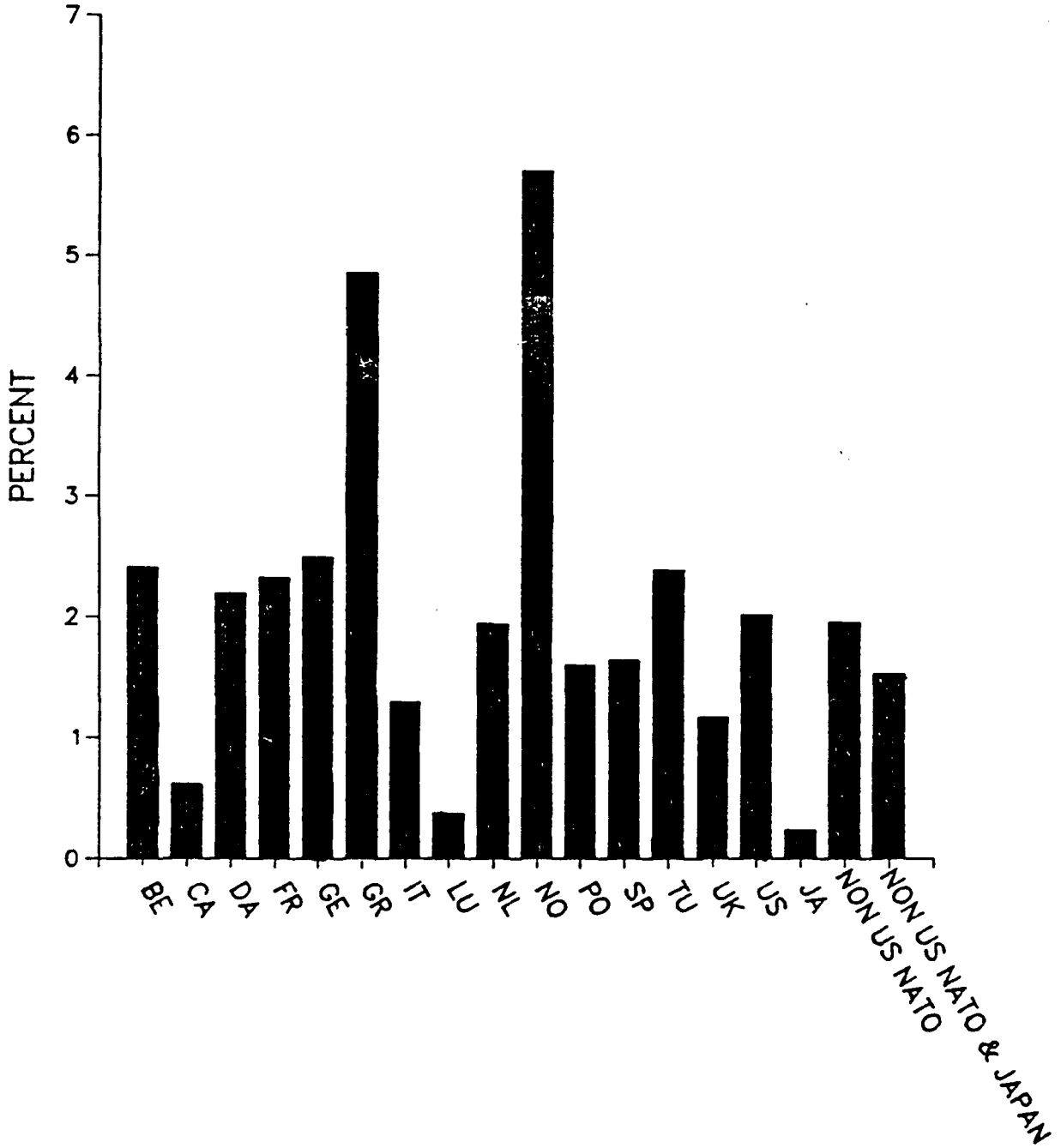

Table 6

Total Active Duty Military and Civilian Manpower and Committed Reserves
(Thousands)
(Including Spain)

	1988		
	% of NATO & Japan Total	% of NATO Total	Rank
Belgium	1.8%	1.9%	12
Canada	1.2%	1.3%	14
Denmark	0.9%	0.9%	15
France	9.9%	10.1%	3
Germany	11.6%	11.8%	2
Greece	3.7%	3.8%	8
Italy	5.6%	5.8%	5
Luxembourg	0.0%	0.0%	16
Netherlands	2.2%	2.2%	10
Norway	1.8%	1.9%	11
Portugal	1.3%	1.3%	13
Spain	4.9%	5.0%	7
Turkey	9.8%	10.1%	4
UK	5.1%	5.2%	6
US	38.0%	38.9%	1
Japan	2.3%		9
Non US NATO	59.7%	61.1%	
Non US NATO + Japan	62.0%		
Total NATO	97.7%	100.0%	

Table 7

Total Active Duty Military and Civilian Manpower and Committed Reserves
As a Percent of Total Population
(Including Spain)

	1988		
	%	% of Highest Nation	Rank
Belgium	2.41	42.3%	4
Canada	0.62	10.9%	14
Denmark	2.19	38.4%	7
France	2.32	40.6%	6
Germany	2.49	43.6%	3
Greece	4.85	85.0%	2
Italy	1.29	22.5%	12
Luxembourg	0.38	6.7%	15
Netherlands	1.94	34.0%	9
Norway	5.70	100.0%	1
Portugal	1.60	28.0%	11
Spain	1.64	28.7%	10
Turkey	2.39	41.9%	5
UK	1.17	20.6%	13
US	2.02	35.5%	8
Japan	0.24	4.3%	16
Non US NATO	1.94	33.9%	
Non US NATO + Japan	1.54	27.0%	
Total NATO	1.97	34.5%	
Total NATO + Japan	1.70	29.7%	

3. Defense Industrial Capacity and Reserve Defense Industrial Capacity.

A difficult area for the proposed model is the availability of specific data to support the comparative evaluation of a nation's defense industrial capacity and reserve defense industrial capacity.

For clarification, the reader should note that reserve industrial capacity represents that production capacity idle at current economic activity levels, plus a designated reserve to be utilized only in time of national crisis or defense mobilization. For the purposes of this model, production output is expected to vary at or below the maximum defense industrial capacity. Reserve capacity should be viewed as a contingency resource not involved in designated defense production until mobilized.

Reserve industrial capacity may be either specifically designated defense goods production, such as tanks, trucks or aircraft or "dual-use" capacity which produces goods serving commercial demand during peacetime which can be refitted or retooled to meet specific defense needs when mobilized. Refitting or retooling would not be necessary for those dual-use industries whose output concurrently meets both defense and commercial applications. In such cases, production output would increase to meet the additional demand. Should requirements be limited by capacity, output lots would be defense designated by priority.

a. Measurement of Capacity

Defense industrial capacities for participating NATO nations are not calculated, tracked or maintained within the Department of Defense at this time. Information available at the time of this writing suggests that production capacities for selected countries are calculated and maintained by the United States Federal Reserve and Department of Commerce, the International Monetary Fund (IMF) and the Organization for Economic Cooperation and Development. Of these sources, none specifically addresses capacities at the sector or industry level, but rather they approach capacity analysis from the point of view of gross factors of production on a national level. Conceptually, the process of determining the production capacity of a specific industry would parallel that currently in use for national capacities.

There are two approaches for estimating industrial capacities that are useful for this model. The first, and least complex, is measurement in the engineering sense which represents the maximum attainable level of output with given factors of production. This method results in a static evaluation without consideration for the dynamic economic variables associated with inflationary pressures, capital markets, labor resource pools and varying energy costs.

The second method is a more complex approach. This method is currently in use by the Organization for

Economic Cooperation and Development (OECD). This concept describes the level of output that is consistent over the medium-term with stable inflation.

The equations describing this approach can be found in work by Torres and Martin, published by OECD. [Ref. 11:p. 130-33] However, it is beyond the scope of this work to manipulate the existing OECD equations in an effort to describe specific industry output. The point of suggesting this method is to illustrate that potential output in the business sector is defined as the level of output derived from the production function[7] using clearly defined inputs. These inputs include factors that represent the cost of capital, the cost of energy, labor efficiency and potential business sector employment. This potential output represents the maximum level of output consistent with stable inflation.

It must be recognized that significant work will be required in grooming this method to meet the needs of describing defense industrial capacity for purposes of comparative analysis. However, drawing on Torres and Martin's work, it can be seen that actual and potential output can be measured and compared in a meaningful way (figure 3). In this example a ratio of actual to potential output is provided.

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[7] Production function is defined as a mathematical expression that relates quantities of inputs to quantities of output produced. Production functions can be used to estimate potential output, assuming full employment of resources with existing technology. When compared to actual output this provides a measure of capacity utilization.

RATIO OF ACTUAL TO POTENTIAL OUTPUT

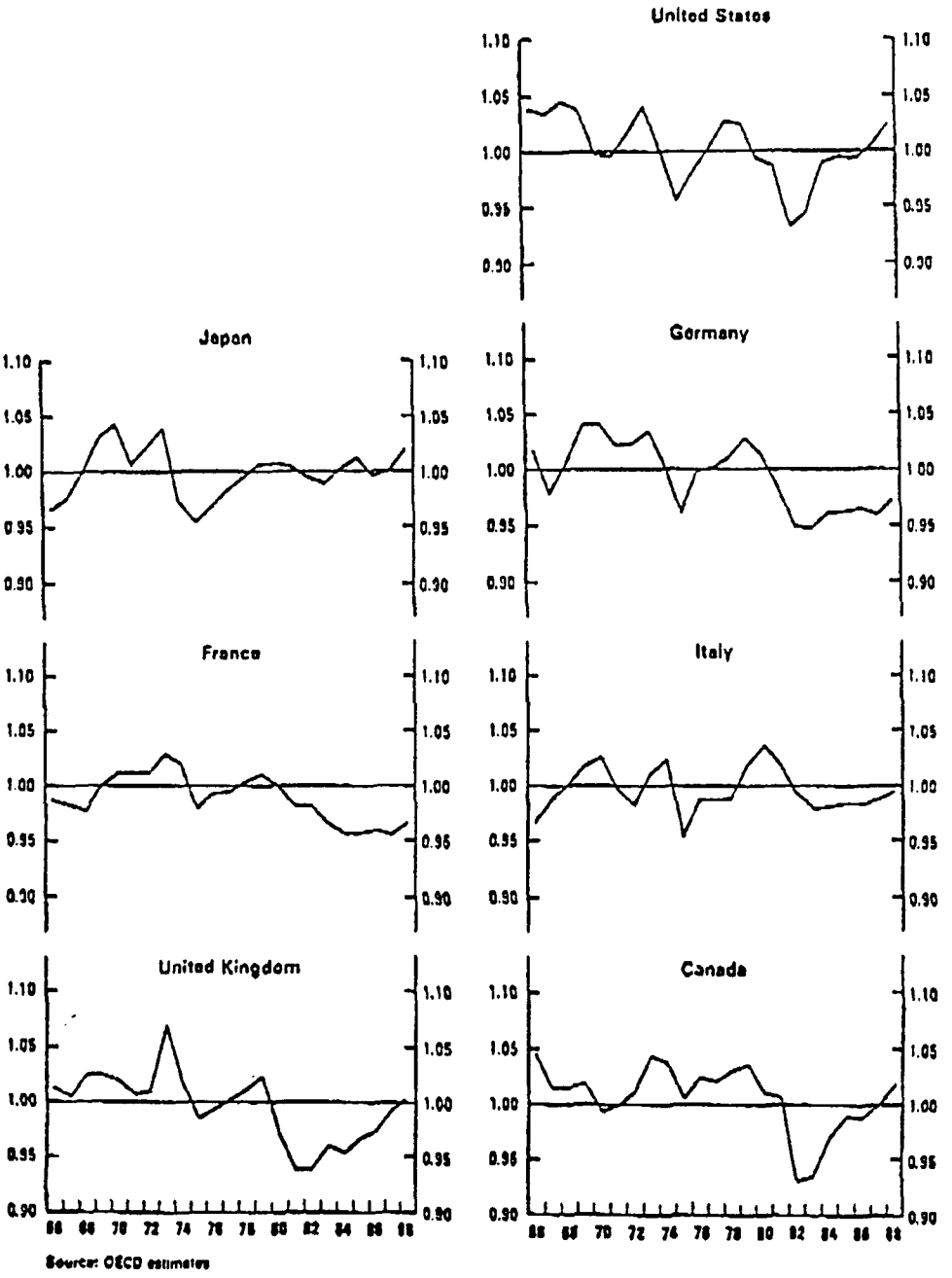

Figure 3

Data similarly compared, that is to say, actual to potential defense industrial output, would serve as input elements for the defense industrial capacity and reserve defense industrial capacity components of the burden-sharing model.

Additional data, as maintained by the Department of Commerce [Ref. 12], including Federal Reserve data, are provided in table 8. These data, while neither defense industry specific, nor inclusive of all NATO participating nations, represent the kind of information required to support comparative evaluation of defense industrial capacities and reserve defense industrial capacities for burden-sharing purposes. The information under the columns labeled Federal Reserve Series is available for the United States only and represents total operating capacity and that portion dedicated to manufacturing. The determination of which method is most suitable, the engineering or the OECD approach, will require further research.

Table 8

RATIOS OF INDUSTRIAL OPERATING CAPACITY UTILIZATION

Period	United States		France	F.R. Germany	Italy	Nether-lands	United Kingdom
	Federal Reserve series						
	Total	Manu-facturing					
				(Percent)			
1980	80.9	79.3	81.5	82.4	72.7	80.0	76.2
1981	79.9	78.2	77.6	79.0	72.6	78.3	73.2
1982	72.1	70.3	77.6	76.4	71.5	77.0	74.2
1983	74.6	73.9	77.2	78.3	70.6	80.0	76.6
1984	81.0	80.5	78.2	80.5	74.9	83.0	82.5
1985	80.4	80.1	79.3	84.2	75.1	84.5	85.8
1986	79.4	79.7	79.0	84.6	75.4	84.3	85.0
1987	80.7	81.1	80.0	84.3	77.1	84.0	87.4
1988	83.3	83.5	82.8	86.7	78.3	84.8	93.6
1989	83.7	83.9					
			Seasonally adjusted *				
1986: I	80.2	80.0	79.3	84.3	74.8	84.0	85.4
II	79.2	79.6	78.9	84.7	75.5	85.0	84.3
III	79.0	79.5	79.1	85.0	75.6	84.0	84.8
IV	79.4	79.8	78.8	84.6	75.9	84.0	85.7
1987: I	79.5	80.0	79.5	83.6	77.3	84.0	86.7
II	79.9	80.5	79.7	84.2	78.1	84.0	87.1
III	81.2	81.4	79.9	84.5	75.6	84.0	86.9
IV	82.1	82.3	80.8	85.0	77.4	84.0	89.1
1988: I	82.4	82.7	82.1	84.7	76.5	84.0	92.6
II	82.8	83.2	82.5	85.9	78.6	85.0	94.8
III	83.8	84.0	83.2	87.4	78.2	85.0	93.3
IV	84.1	84.4	83.3	88.7	79.9	85.0	93.9
1989: I	84.0	84.4	83.8	87.9			
II	84.1	84.4					
III	83.7	84.0					
IV	83.1	83.0					

* Except for France, Italy, and Netherlands.

4. Related Defense Factors

The related defense factors component of the burden-sharing model is intended to recognize and equalize expenditures that are not clearly associated with defense capital purchases or operational costs, which still play a significant role in the overall efficiency of the defense alliance.

Some nations feel their defense efforts are understated by specific indicators of actual contributions. Issues such as host nation support, civil emergency planning efforts, aid to developing countries and aid to developing defense industries all have a significant role in the overall defense mission of the alliance, but are not credited as contributions under the current formula.

Real estate provided for forward deployed forces has a clear opportunity cost when compared with alternative uses in the private sector. The current market value of real estate made available to Allied forces stationed in Germany, for example, has been estimated at nearly $24 billion [Ref. 3:p. 2-15].

The hardening of some civil projects to serve as population shelters is seen in many European and Scandinavian countries. These expenditures, together with reinforcement for roads, pipelines and civil communications systems have direct military support applications, yet cannot be reported under NATO's defense accounting criteria.

Consideration for contributions to developing countries and developing defense industries should also be assigned in this component. There may be positive stability implications within the NATO alliance associated with assisted development, and the defense industrial capacity increase to be realized as developing defense industries mature is clearly supportive of the alliance mission.

Few of these issues lend themselves to clear assignment of value in the burden-sharing sense. Different factors of production and economic circumstances will provide different costs for the same project in two countries. Such differences will require normalization if they are to be commonly accepted to the accounting of burden-share. Historically, attempts at normalization have been based upon monetary exchange rates, but this fails to account for the production efficiency of the economy.

Information on developmental assistance is generated and maintained by OECD. This information is used by DoD in the evaluation of comparative developmental assistance. Table 9 displays net official developmental assistance as provided by OECD and reported by DoD. [Ref. 3] These data are considered useful for the support of related defense factors.

Table 9

NET OFFICIAL DEVELOPMENTAL ASSISTANCE

	PERCENT OF GDP						$ MILLIONS					
	1980	1984	1985	1986	1987	1988	1980	1984	1985	1986	1987	1988
Belgium	0.50	0.58	0.55	0.48	0.48	0.40	595	446	440	547	687	597
Canada	0.43	0.50	0.49	0.48	0.47	0.49	1,075	1,625	1,631	1,695	1,885	2,342
Denmark	0.74	0.85	0.80	0.89	0.88	0.89	481	449	440	695	859	922
France	0.63	0.77	0.78	0.70	0.74	0.72	4,162	3,788	3,995	5,105	6,525	6,865
Germany	0.44	0.45	0.47	0.43	0.39	0.39	3,567	2,782	2,942	3,832	4,391	4,731
Italy	0.15	0.28	0.26	0.40	0.35	0.39	683	1,098	1,098	2,404	2,615	3,183
Japan	0.32	0.34	0.29	0.29	0.31	0.32	3,353	4,319	3,797	5,634	7,342	9,134
Netherlands	0.97	1.02	0.91	1.01	0.98	0.98	1,630	1,268	1,136	1,740	2,094	2,231
Norway	0.87	1.03	1.01	1.17	1.09	1.10	486	540	574	798	890	985
United Kingdom	0.35	0.33	0.33	0.31	0.28	0.32	1,854	1,429	1,530	1,737	1,871	2,645
United States	0.27	0.24	0.24	0.23	0.20	0.21	7,138	8,711	9,403	9,564	8,945	10,141
Non-US NATO	0.47	0.52	0.52	0.52	0.50	0.53	14,533	13,425	13,786	18,553	21,817	24,501
NATO	0.38	0.36	0.35	0.36	0.35	0.36	21,671	22,118	23,189	28,117	30,762	34,642
NATO & Japan	0.37	0.35	0.34	0.35	0.34	0.35	25,024	26,455	26,986	33,751	38,104	43,776

Source: OECD "1989 Report on Development Cooperation in the 1990s", December 1989, page 227, includes net official development assessment of Development Assistance Committee (DAC) members to developing countries and multilateral agencies.

Model Application

It is important to reiterate that the intent of the proposed model is not to produce a single quantifiable index for defense burden comparison. Rather, it should ultimately produce segregated quantifiable elements that together will provide a relative indication of the performance of member nations in terms of contribution to alliance efficiency.

C. LIMITATIONS OF THE MODEL

This thesis seeks to redefine NATO defense burden-sharing in terms that differ from those that have historically been used. The proposed model, while comprehensive in the inclusion of substantive elements of defense burden is not without limitations.

The limitations of this model can be categorized as functional limitations, those which make the model difficult to implement at this time; and political and economic limitations, which result in differing definitions of the elements of the model and differing motives or incentives for participation and providing information to support the model.

The functional limitations are associated with the data required to support analysis and evaluation of defense burdens within the framework of the model, the most critical being the availability of data on the defense industrial bases of participating nations. At the time of this writing, the United States does not maintain data specifically on the defense industrial sector of the economy. It is assumed that

other NATO nations do not gather or maintain such data. This assumption is based on the lack of evidence available through normal research channels.

Clearly information concerning the industrial capacities and capacity utilization is calculated and maintained for key industries and economies in general. However, to support the model of burden-sharing proposed herein, specific data on defense industrial capacities and reserve defense industrial capacities would be required.

Central to the development of such a database is the method by which such information could be generated. A related mathematical model, utilized by the Organization for Economic Cooperation and Development for generation of macroeconomic[8] capacities, has been suggested in this thesis as a possible starting point for quantifying capacities and capacity utilization of member nations. Significant additional work is required to define the input functions and equation variants appropriate to such a narrowly defined sector of the economy.

The component of the burden-sharing model titled Related Defense Factors (e.g., host nation support, civil emergency planning, aid to developing countries, aid to developing defense industries and dedicated real estate) seeks to aggregate those elements of the burden that are not as easily

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[8] Macroeconomic capacities in this sense refer to output quantification of the entire economy rather than a specific sector or industry.

quantifiable as manpower and armaments. The reason these elements elude quantification is that the value associated with each is a matter of perception by various nations. Here then exists a requirement to negotiate agreement on the method of valuing such contributions. Since members may contribute differently in this area, a method of equivalent contribution of share must be devised.

Additional limitations lie in the realm of politics and economic philosophy. Any system that seeks to compare common activities between nations must somehow allow for differing political systems and economic priorities.

Of concern here are the internal economic priorities established and pursued by member nations. Should they differ significantly from those of other participating nations, there may exist incentives to limit or tailor data to suit national economic priorities at the expense of alliance efficiency or fair share. This might take the form of free-riding, as discussed earlier under Perceptions and Burden-Sharing, or exaggerating contributions. Allowing maximum credit for significant contributions to alliance efficiency under Related Defense Factors may dilute some incentive for such actions, since operational force contributions would be off-set by contributions which internally benefit the contributing nation. Until common definitions of contribution and equivalent measures between different economies are

established, pressures to favor ones national position will exist.

It is necessary to recognize the possible political incentive of some nations to protect defense industrial capacity and reserve defense industrial capacity data on grounds of national security interests. Where no specific case is cited, the reader is reminded of the security sensitivity that might be associated with revealing total production potential including surge capability. While not to be discounted, it is assumed in general that the strength of the alliance and the benefits of membership will supercede such concerns.

D. CONCLUSIONS AND RECOMMENDATIONS

The objectives of this thesis included the development of a model which incorporated the fundamental components of defense burden-sharing categorized as standing forces, reserve forces, defense industrial capacity, reserve defense industrial capacity and related defense factors. In addition, the intent included the exploration of the availability of information to support such a model.

While not inclusive of every aspect of the defense burden, the model presented in this work clearly represents the major areas of contribution that are identifiable, and to a reasonable degree quantifiable.

The intent of the model in not to produce a single index by which member nations are compared, but rather categories

through which a relatively greater contribution in one area might off-set a deficiency in another. By including more of what constitutes real defense contribution in the model, an approach to burden-sharing that is perceived as fair to all participants, from the standpoint of recognizing contribution, is achieved.

The model provides a reasonable representation of defense contribution. Because this model is limited by the availability of information to support it, the following recommendations are offered:

1. The proposed model should be developed in greater detail using expanded OECD production criteria tailored specifically to defense industries.
2. Efforts should be made to develop reporting and documentation requirements for participating nations using the Defense Planning Questionnaire as an initial vehicle.
3. A data base should be established and maintained for the evaluation and tracking of defense industrial capacities and reserve defense industrial capacities.

These together will provide a framework of information to support the evaluation of burden shares using the proposed model.

In conclusion, the proposed model represents an alternate approach to the evaluation of defense contribution which includes components that historically have not been credited. Further, significant information is available to support the operational components of the model, but additional development is required for the non-operational components.

III. ISSUES FOR FURTHER RESEARCH

Any effort to define a specific quantity, in an area with so many complex and subjective variables, must generate many questions that can only be answered through additional research. The following represent issues that when resolved will add significantly to the ability to clearly analyze and quantify the relative defense contribution of alliance members.

Perhaps the most obvious issue concerns the modeling of nations' defense industrial capacity and reserve defense industrial capacity. Techniques for estimating capacity utilization on a national basis have been described, but it appears that no specific work concerning defense industry modeling has been carried out to date. This effort may initially involve the development of a comprehensive data base, but should evolve into the development of a specific defense industry output equation to meaningfully support the burden-sharing model proposed herein.

A secondary issue to the measurement of defense industrial capacity is the measurement method itself. Comparison between the OECD approach, using a medium-term, stable inflation, dynamic model and a basic engineering approach, which measures maximum output with specified factors of

production, will be of value in the refinement of the burden-sharing model.

We expect defense industrial output to increase as crisis demand is generated. Conditions which may precipitate that crisis demand however, may also affect critical input factors for that industry. For example, large scale mobilization will directly impact the labor pool and may impact such factors as petroleum or other raw materials not defined here. Of concern is the impact that mobilization will have on the secondary factors that affect the ability of an industry to increase output.

Assuming a continued favorable trend in international relations, what existing defense industries can be converted or modified to allow dual-use application? This conversion concept would allow the preservation of certain defense industries in peacetime as budget contraction occurs. This area may include consideration for commercial computer aided design and manufacturing (CAD/CAM) operations that can be reprogrammed to meet defense output requirements on demand.

Mentioned specifically in the model is the requirement to define, in depth, the reserve force contribution to operational readiness. This will include mobilization and deployment time lines, and current Division Equivalent Firepower defined on a unit basis. Such classification might be expanded to include tactical aircraft capabilities, surface

naval combatant capabilities, unit training, experience levels and morale.

Under the component of related defense factors, assessment and development of criteria for evaluating and weighing civil projects is required. [p. 50] Since these contributions are meaningful in the context of defense preparedness, a standard of equivalence should be developed to ensure fair credit is given to participating nations.

Issues concerning the provision and evaluation of defense contribution information may include the conduct of an initial survey of participating nations as to their willingness to provide such specific industrial data as is called for by this model. Assuming a favorable response, the Defense Planning Questionnaire should be revised to provide for inclusion of such data by participating nations. The political sensitivities associated with such efforts are recognized.

Finally, with the collapse of the Warsaw Pact and its associated military threat, new issues arise that are concerned with the decision process through which alliance forces will be committed to action. What force strength is appropriate for contingency operations and low intensity conflict, and under what circumstances will they be committed? How will the lack of a clearly defined threat affect nations' acceptance of burden shares?

Each of these areas, examined and defined in detail, will contribute directly to the quantitative comparison of defense

burden within the framework of the model described in this work.

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APPENDIX

TABLE A-1

Tactical Fixed-Wing Naval Combat Aircraft

	1988		
	% of NATO & Japan Total	% of NATO Total	Rank
Belgium	0.0%	0.0%	
Canada	0.0%	0.0%	
Denmark	0.0%	0.0%	
France	4.5%	4.5%	2
Germany	4.5%	4.5%	3
Greece	0.0%	0.0%	
Italy	0.0%	0.0%	
Luxembourg	0.0%	0.0%	
Netherlands	0.0%	0.0%	
Norway	0.0%	0.0%	
Portugal	0.0%	0.0%	
Spain	0.5%	0.5%	5
Turkey	0.0%	0.0%	
UK	2.8%	2.8%	4
US	87.7%	87.7%	1
Japan	0.0%		
Non US NATO	12.3%	12.3%	
Non US NATO + Japan	12.3%		
Total NATO	100.0%	100.0%	
Total NATO + Japan	100.0%		

TABLE A-2

Maritime Patrol Aircraft

	1988		
	% of NATO & Japan Total	% of NATO Total	Rank
Belgium	0.0%	0.0%	
Canada	2.8%	3.3%	6
Denmark	0.0%	0.0%	
France	4.7%	5.5%	4
Germany	2.2%	2.6%	8
Greece	2.0%	2.4%	10
Italy	2.2%	2.6%	7
Luxembourg	0.0%	0.0%	
Netherlands	2.0%	2.4%	9
Norway	1.1%	1.3%	11
Portugal	0.0%	0.0%	
Spain	0.9%	1.1%	12
Turkey	2.8%	3.3%	5
UK	5.3%	6.2%	3
US	59.7%	69.5%	1
Japan	14.1%		2
Non US NATO	26.2%	30.5%	
Non US NATO + Japan	40.3%		
Total NATO	85.9%	100.0%	
Total NATO + Japan	100.0%		

TABLE A-3

Tactical Air Force Combat Aircraft

	1988		
	% of NATO & Japan Total	% of NATO Total	Rank
Belgium	2.2%	2.3%	12
Canada	2.4%	2.5%	10
Denmark	1.0%	1.0%	13
France	9.6%	9.9%	3
Germany	6.0%	6.3%	4
Greece	4.8%	5.0%	6
Italy	5.3%	5.5%	5
Luxembourg	0.0%	0.0%	
Netherlands	2.3%	2.4%	11
Norway	0.9%	0.9%	15
Portugal	0.9%	0.9%	14
Spain	2.5%	2.6%	9
Turkey	3.9%	4.0%	7
UK	9.8%	10.2%	2
US	44.7%	46.4%	1
Japan	3.7%		8
Non US NATO	51.6%	53.6%	
Non US NATO + Japan	55.3%		
Total NATO	96.3%	100.0%	
Total NATO + Japan	100.0%		

TABLE A-4

Naval Force Tonnage
(All Ships Less Strategic Submarines)

	1988		
	% of NATO & Japan Total	% of NATO Total	Rank
Belgium	0.3%	0.3%	15
Canada	1.6%	1.7%	10
Denmark	0.4%	0.4%	14
France	6.8%	7.1%	3
Germany	3.0%	3.1%	5
Greece	1.7%	1.8%	9
Italy	2.1%	2.2%	8
Luxembourg	0.0%	0.0%	16
Netherlands	1.3%	1.4%	11
Norway	0.6%	0.6%	12
Portugal	0.6%	0.6%	13
Spain	2.6%	2.7%	7
Turkey	2.6%	2.7%	6
UK	11.4%	11.9%	2
US	60.7%	63.4%	1
Japan	4.3%		4
Non US NATO	35.0%	36.6%	
Non US NATO + Japan	39.3%		
Total NATO	95.7%	100.0%	
Total NATO + Japan	100.0%		

TABLE A-5

Naval Force Tonnage
(Principal Surface Combatants)
(Thousands)

	1988		
	% of NATO & Japan Total	% of NATO Total	Rank
Belgium	0.4%	0.4%	15
Canada	2.7%	2.9%	6
Denmark	0.4%	0.4%	14
France	5.6%	6.0%	4
Germany	2.5%	2.7%	9
Greece	2.6%	2.7%	8
Italy	3.8%	4.0%	5
Luxembourg	0.0%	0.0%	
Netherlands	2.4%	2.6%	11
Norway	0.8%	0.8%	13
Portugal	1.2%	1.3%	12
Spain	2.7%	2.9%	7
Turkey	2.5%	2.7%	10
UK	7.9%	8.5%	2
US	58.1%	62.1%	1
Japan	6.4%		3
Non US NATO	35.5%	37.9%	
Non US NATO + Japan	41.9%		
Total NATO	93.6%	100.0%	
Total NATO + Japan	100.0%		

TABLE A-6

Submarine-Launched Ballistic Missile Tubes

	1988			
		% of NATO & Japan Total	% of NATO Total	Rank
Belgium	0	0.0%	0.0%	
Canada	0	0.0%	0.0%	
Denmark	0	0.0%	0.0%	
France	96	11.8%	11.8%	2
Germany	0	0.0%	0.0%	
Greece	0	0.0%	0.0%	
Italy	0	0.0%	0.0%	
Luxembourg	0	0.0%	0.0%	
Netherlands	0	0.0%	0.0%	
Norway	0	0.0%	0.0%	
Portugal	0	0.0%	0.0%	
Spain	0	0.0%	0.0%	
Turkey	0	0.0%	0.0%	
UK	64	7.8%	7.8%	3
US	656	80.4%	80.4%	1
Japan	0	0.0%		
Non US NATO	160	19.6%	19.6%	
Non US NATO + Japan	160	19.6%		
Total NATO	816	100.0%	100.0%	
Total NATO + Japan	816	100.0%		

TABLE A-7

Intercontinental Ballistic Missiles
Intermediate-Range Ballistic Missiles

	1988			
		% of NATO & Japan Total	% of NATO Total	Rank
Belgium	0	0.0%	0.0%	
Canada	0	0.0%	0.0%	
Denmark	0	0.0%	0.0%	
France	18	1.8%	1.8%	2
Germany	0	0.0%	0.0%	
Greece	0	0.0%	0.0%	
Italy	0	0.0%	0.0%	
Luxembourg	0	0.0%	0.0%	
Netherlands	0	0.0%	0.0%	
Norway	0	0.0%	0.0%	
Portugal	0	0.0%	0.0%	
Spain	0	0.0%	0.0%	
Turkey	0	0.0%	0.0%	
UK	0	0.0%	0.0%	
US	1000	98.2%	98.2%	1
Japan	0	0.0%		
Non US NATO	18	1.8%	1.8%	
Non US NATO + Japan	18	1.8%		
Total NATO	1018	100.0%	100.0%	
Total NATO + Japan	1018	100.0%		

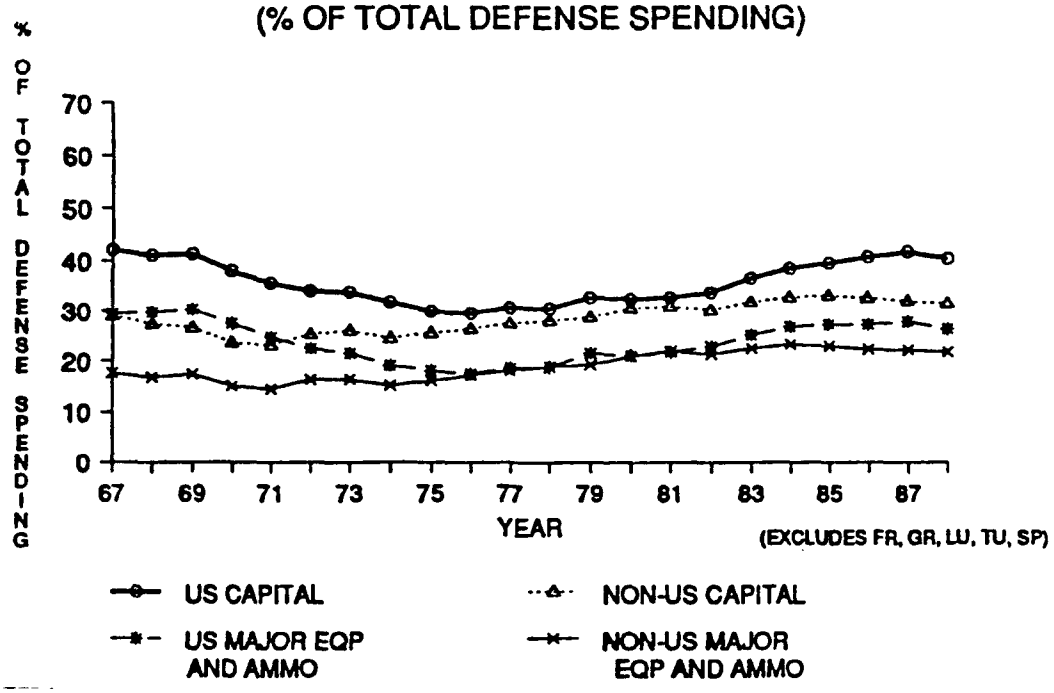
TABLE A-8

Strategic Nuclear Bombers

	1988			
		% of NATO & Japan Total	% of NATO Total	Rank
Belgium	0	0.0%	0.0%	
Canada	0	0.0%	0.0%	
Denmark	0	0.0%	0.0%	
France	18	4.4%	4.4%	2
Germany	0	0.0%	0.0%	
Greece	0	0.0%	0.0%	
Italy	0	0.0%	0.0%	
Luxembourg	0	0.0%	0.0%	
Netherlands	0	0.0%	0.0%	
Norway	0	0.0%	0.0%	
Portugal	0	0.0%	0.0%	
Spain	0	0.0%	0.0%	
Turkey	0	0.0%	0.0%	
UK	0	0.0%	0.0%	
US	393	95.6%	95.6%	1
Japan	0	0.0%		
Non US NATO	18	4.4%	4.4%	
Non US NATO + Japan	18	4.4%		
Total NATO	411	100.0%	100.0%	
Total NATO + Japan	411	100.0%		

TABLE A-9

US AND NON-US NATO SPENDING FOR CAPITAL AND MAJOR EQUIPMENT & AMMUNITION (% OF TOTAL DEFENSE SPENDING)



US AND NON-US NATO SPENDING FOR PERSONNEL & OTHER OPERATING EXPENDITURES (% OF TOTAL DEFENSE SPENDING)

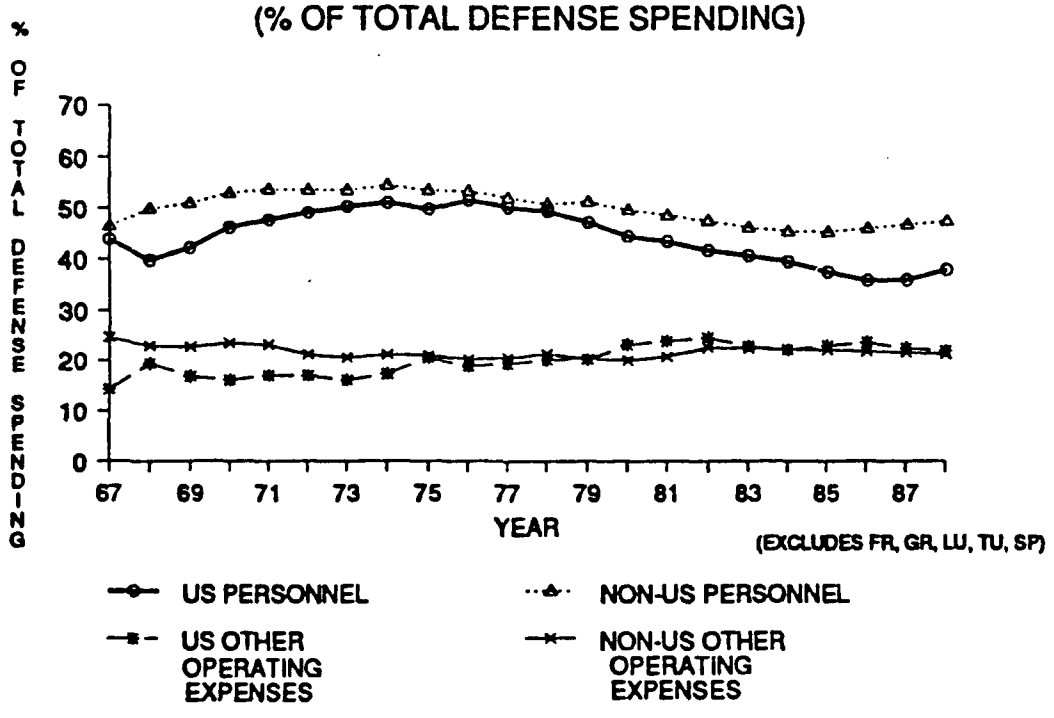
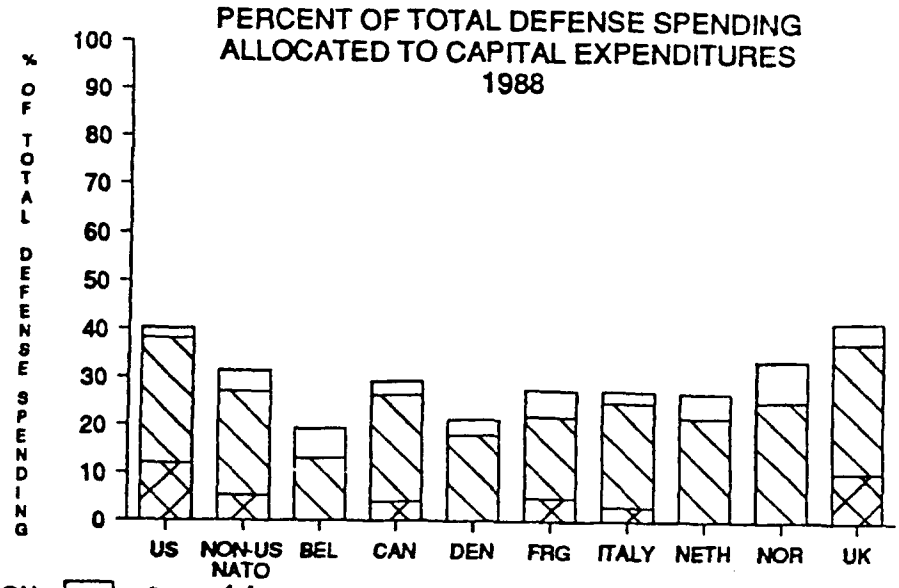
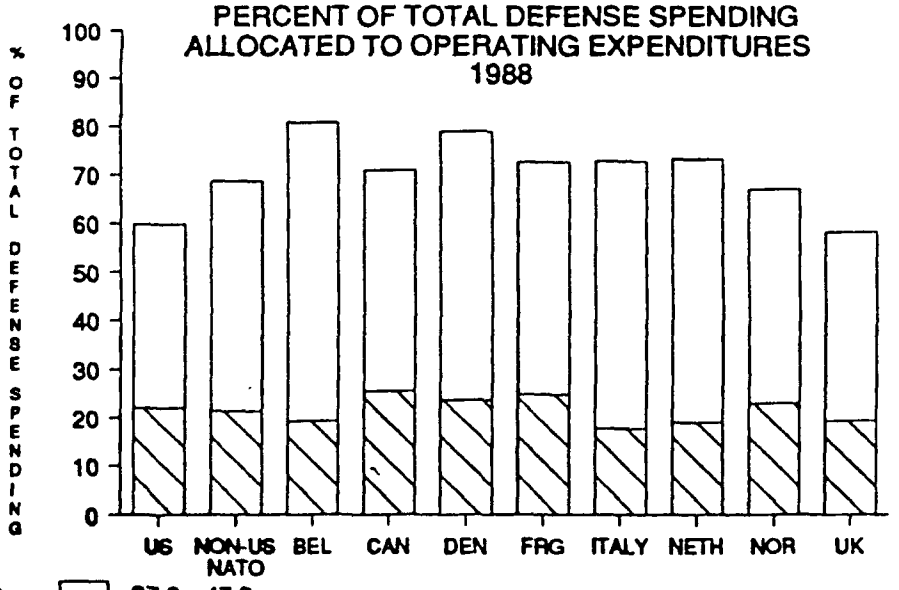


TABLE A-10



	US	NON-US NATO
MILCON	2.0	4.4
EQUIP	26.3	21.7
RDT&E	11.9	5.3
TOT CAP	40.2	31.4



	US	NON-US NATO
PERS	37.8	47.3
O&M	22.0	21.3
TOT OP	59.8	68.6

NON-US AVERAGE EXCLUDES FR, GR, LU, TU, SP

TABLE A-11

Selected Indicators of Ability to Contribute
(Including Spain)

Rank	GDP Share		Population Share	
1	US	36.93%	US	31.82%
2	JA	21.86%	JA	15.84%
3	GE	9.24%	GE	7.89%
4	FR	7.30%	IT	7.42%
5	IT	6.37%	UK	7.36%
6	UK	6.30%	FR	7.22%
7	CA	3.71%	TU	7.00%
8	SP	2.61%	SP	5.04%
9	NL	1.74%	CA	3.35%
10	BE	1.13%	NL	1.91%
11	DA	0.83%	PO	1.33%
12	NO	0.70%	GR	1.29%
13	TU	0.50%	BE	1.28%
14	GR	0.40%	DA	0.66%
15	PO	0.32%	NO	0.54%
16	LU	0.05%	LU	0.05%
Non US NATO		41.21%		52.34%
Non US NATO + Japan		63.07%		68.18%
Total NATO		78.14%		84.16%
Total NATO + Japan		100.00%		100.00%

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